Pamph.
Anthrop.
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PALÆOLITHIC MAN

IN

EASTERN AND CENTRAL NORTH AMERICA.

(PART III.)

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V. Concluding remarks by the President, with illustrations of Palæolithic Implements from Delaware, Indiana, New Jersey and Minnesota. F. W. Putnam, p. 158.

[Reprinted from the Proceedings of the Boston Soc. Nat. Hist., Vol. xxiv.]

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EARLY MAN IN THE DELAWARE VALLEY.

BY HILBORNE T. CRESSON.

Special assistant of the Peabody Museum.

At Professor Putnam's request, I have prepared this brief account of work carried on for the past two years, under the direction of the Peabody Museum, and included some previous researches, the results of which will shortly be arranged and exhibited in the cases of the Peabody Museum.

In studying the traces of early man that have been discovered in the lower Delaware Valley, a few hours' journey southwest of the renowned Trenton gravels, so well known by the untiring labors of Dr. Charles C. Abbott, it is well at once to introduce you to the neighborhood called Naaman's Creek, better known, however, at the present day as Claymont, a small hamlet lying just beyond Mason and Dixon's line, in New Castle County, State of Delaware. In order that you may better understand the exact geographical position of Naaman's Creek, around whose mouth and head-waters the early people of the Delaware Valley evidently found attractive hunting-grounds, among the terraces and hills of the interior and the marshes of the river shore, it will be best to refer to the map. Taking New Jersey as a point well known to all, a glance in a southwesterly direction, for a short distance, brings the eye to Philadelphia, and about twenty-two miles farther on, the line between Delaware and Pennsylvania is somewhat conspicuous from the fact that instead of the usual straight dividing line between states, we have here a semicircle, that curves around from the Delaware River in a westerly, and then southerly direction, dividing Delaware from Pennsylvania and Maryland. The position of Claymont village may then be easily remembered, for it stands within rifle shot of the Delaware, directly alongside of the state line referred to. So much for the geography of the locality.

Let me now say a few words upon the geological situation, making a few brief allusions to the Philadelphia red-gravel and brick-clay.

Underlying the city of Philadelphia, and points west and southwest of it as well, are two distinct layers of gravel easily distinguished from each other by their color: a dull yellow, and a brilliant red. Overlying the gravel deposit is a layer of boulder clay which, from its fictile adaptability, has been named the Philadelphia brick-clay. The oldest of these gravels just referred to, the yellow, does not concern us, from the fact that the fragments of coral and shell pebbles that are at times found in it suggest the probable debris of some old tertiary shore line. It cannot therefore have any connection with the far more recent conditions relating to the finds at Naaman's Creek, except, that at this last-named place it underlies the boulder clay or gravel in the same order that it does at

Philadelphia, or is replaced by schists. Just above the yellow, is a layer of red ferruginous gravel, in which quartzite predominates with a less proportion of sandstone, chert, and hornstone. These materials, it is true, are found in the yellow gravel, but in the red gravel, at Philadelphia, we have another constituent which is never found in the former, and that is pebbles of red shale.

In the brick clay already referred to, lying above the red gravel, will be found water-worn boulders of Cambrian quartzite, Silurian sand-rock, and shale from the Triassic formation, for whose origin we must look toward the north around the head-waters of the Delaware. The boulder clay and red gravel are confined to certain limits on either side of the Delaware river, and its tributary the Lehigh. At Philadelphia, the two deposits extend back from the waters of the first named stream, an average distance of three or four miles; *the clay deposit*, in some cases, mounting the slopes of a line of hills in the neighborhood of the city, to a distance of two hundred feet.

Without going into any further description of the postglacial deposits underlying Philadelphia, deposited by great floods during the periodical meltings of the great ice sheet, allow me to add that the geologist will find the same deposit running along the Delaware's banks from Philadelphia to Chester, and thence southward, far beyond the point in which we are interested — that of Naaman's Creek. Any one who will follow the numerous deep cuts of the Baltimore and Ohio railroad from Philadelphia to Wilmington, will be impressed with the truth of these statements, and be rewarded with rare opportunities for study.

In considering the remains of early man that have been found near the head-waters of Naaman's Creek, it will be well to refer to the first discovery that attracted attention to this neighborhood in 1866. It is now rather late to mention it, but, although at that time *little* was thought of the remains of the rock-shelter that I shall describe, at the present day the implements of its several layers are of the greatest interest to the anthropologist. We now have means of comparison which we did not have twenty years ago, and experience has taught us to preserve the smallest flake or sherd, no matter how uncouth it be, for each contributes its mite towards the history of early man.

The remains of the Naaman's Creek Rock-shelter luckily fell into hands that have preserved them, and thanks to the Museum which bears the name of one of America's greatest benefactors, George Peabody, the specimens will soon be arranged and exhibited for future reference. To pass on in this connection, and not mention the indefatigable efforts of the directors of the Peabody Museum in the interests of science would be a great injustice. Thanks to the energy of the staff of this great Museum, America possesses an extensive treasure-house of archæological and ethnological lore, which considering the comparatively short time that has elapsed since the first specimen was labelled is, without doubt, one of the most valuable and interesting collections ever brought together, rivalling any of like kind in either hemisphere.

To give a detailed account of *how* the Rock-shelter at Naaman's Creek was discovered, would consume too much time this evening, Let us rather consider, briefly, the nature of the rock composing it and the contents of the shelter's various layers. In all probability, the rock forming a shelter *was* a Laurentian outcrop — probability is mentioned because no exact geological survey has ever been made of the locality, so far as I am aware, up to the time of Professor Wright's visit to the spot last month. I say *was* a Laurentian outcrop from the fact that the site of the shelter has, within a few years, been cut in twain and all but one side of its place obliterated by the Baltimore and Ohio railroad company's trackway, made through the Laurentian outcrop, from which a mass of rock formerly projected, making a natural shelter that at times was used by the early peoples of the Delaware valley. The Peabody Museum possesses photographs of the spot as it appears at the present day, which may be seen by all interested in the subject. Fortunately, careful drawings of the shelter were made during its excavation, between the years of 1866 and 1867, copies of which have been presented to the Museum by William R. Thompson, Esq., of Philadelphia. Any one interested in photography will readily understand how, but a few years ago, it would have been a difficult matter, if not an impossibility, to have obtained photographs of the spot. A camera, in those days, with its appliances, would have required a horse and cart to carry them.

The profile drawing on the following page represents the outcrop of rock as it appeared above the ground line, before excavations were begun in 1866. The trees show that the ground was then covered by a thick wood. The outcrop of the rock *R*, above the ground line *G G*, is plainly indicated. From the point *P*, that

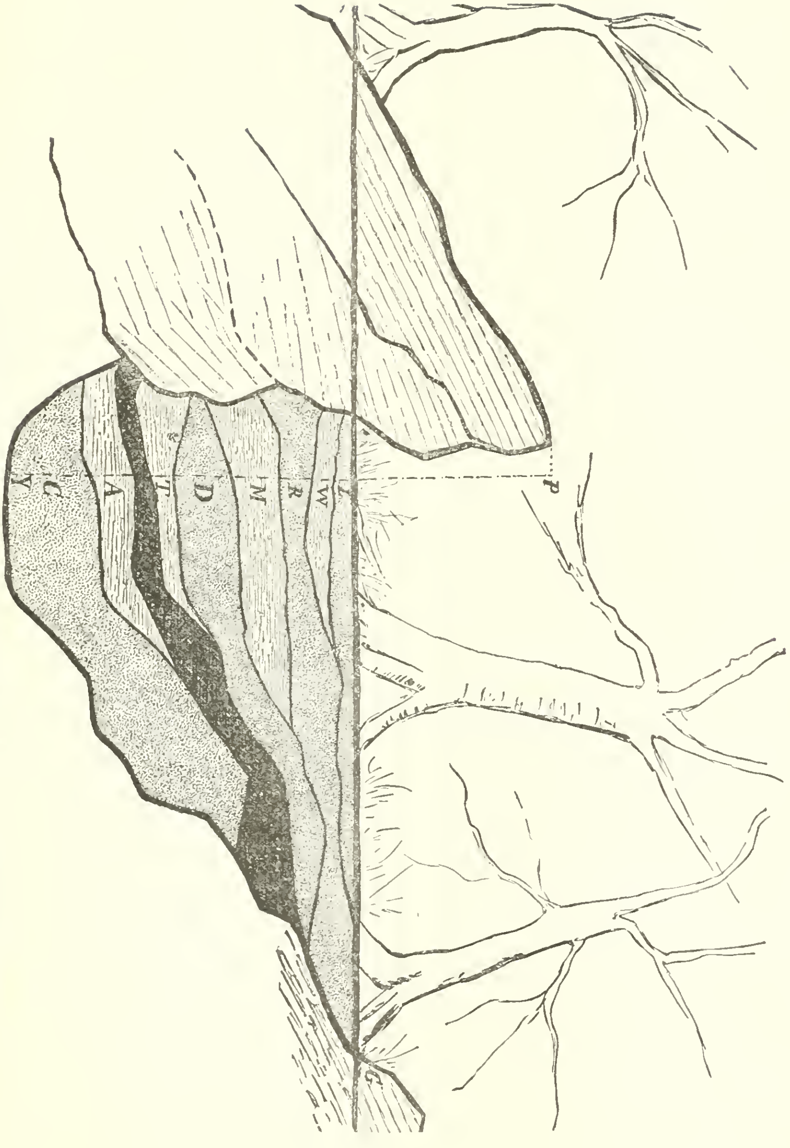

Fig. 1. Rock-shelter at Naaman's Creek, Delaware. *A, T, M* and *W* are the layers containing implements.

marks the innermost edge of the outcrop overhanging the hollow *P Y G*, a perpendicular line dropped to the intersection of the ground line[1], would measure five and one-eighth feet, the height of the projection of the rock above the ground before the excavations were commenced.

Twenty-two feet, eight inches, from the outcrop *R*, measured from its inner face *P*, there is still another outcrop of Laurentian rock, marked *G* on the diagram. This marks the opposite side of the hollow, the profile outline of which is easily made out by the thick line running from *G* to *Y*. Carrying the eye upward to *P*, the angle of projection of the rock, over the depression *P Y G*, is readily understood.

It is thus evident how admirably the place was adapted to the wants of the early hunters of the Delaware Valley, whether it be as a shelter, or as a place of defence against their enemies.

Contenting ourselves with this hasty sketch of the shelter's profile, and the suggestion that the hollow beneath the projecting rock was the result of erosion, let us consider for a moment the layers of earth, sand and gravel that filled it, these being intermingled with rude implements, broken bones, and charcoal, indicating that man at times had resorted to the spot.

Layer C.—This was composed of schist, resting on the Laurentian? bed rock (*Y*) of the shelter. A layer of aqueous gravel of the same character as that underlying Philadelphia rested on the decomposed schist. The greatest depth of the red gravel layer was 4 feet 2¼ inches, measured from the layer of decomposed schist. Least depth of gravel observed, 1 foot, 3 inches. These measurements were verified by me at the final excavations made through the shelter by the Baltimore and Ohio railroad company in 1887. New geological specimens were also obtained of the different layers, as some of those obtained in 1866 were lost during changes that have taken place in the household of the gentleman who preserved the collection until the time of its presentation to the Peabody Museum.[2]

Layer A.— This was a layer of grayish white brick-clay mixed with yellow clay similar to that underlying Philadelphia, on top of which was a layer mixed with sand, shown by the black space. Stone implements were discovered in this layer. They were but few in number and very rude, exclusively of argillite, and palæolithic in type. Greatest depth of layer, 2 feet, 1½ inches. Least depth, observed, 1 foot, 4 inches. No implements of bone were found.

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[1] The point where the line *P* cuts the ground line *G* is here referred to.

[2] A portion of the specimens from the rock-shelter were accepted in 1884 as a consideration for my services rendered in superintending the excavations during the summers of 1866–7–8. At the earnest request of the curator they have been presented to the Peabody Museum.

I should here state that the continual infiltration of water from a spring on the surface soil near by, made it very difficult to examine the layers; much of the material contained in them being so decomposed that it was impossible to save it. Here and there, however, by using great care the remains of different animals were secured; and, on a following page, I give a list of these identified by the late Dr. Shivers of Naaman's Creek.

Layer T.—This was of reddish gravel intermingled with decomposed schist, cinders, and broken bones of animals. Fragments of a human skull were found at the spot marked on the sketch in this layer. A fragment of a human rib was also discovered. The fragments of the skull are covered, here and there, by dendritic incrustations. Rudely chipped points and other implements, all of argillite, were found in this layer. Depth of layer 13 to 18 inches.

Layer D.— Composed of reddish-yellow clay. Depth, 2 feet, 3 inches. No implements.

Layer M.— In this layer were numerous implements of argillite and some of bone, intermingled with rude implements of quartzite and jasper and fragments of rude pottery with charcoal. Greatest depth, 1 foot, 1½ inches. Least depth, 3 inches.

Layer R.— Yellow clay. Greatest depth, 2 feet, 1½ inches; least depth, 8 inches. No implements.

Layer W.— This contained chipped implements, those made of jasper and quartzite predominating over those of argillite. Implements of bone and ornaments of stone, bone and shell. In the lower part of this layer were fragments of rude pottery. In the upper portion of the layer were potsherds decidedly superior in decoration and technique to those from the lower portion. Geological composition of this layer, yellow clay loam. Greatest depth, 3 feet, 4 inches. Least depth observed, 2½ inches.

Layer L.—This consists of leaf mold, 7 inches thick, converted into swamp muck by decomposing action of water from springs.[1] No implements.

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[1] The position of the spring referred to was about ten feet to the right of the outcrop *G* (see plan, p. 145), and being somewhat elevated above the shelter a portion of its waters flowed into the depression between the outcrops *P* and *G*.

The following is a list of the remains of animals found in the several layers as indicated by the "cross":—

Layers.	A	T	M	W
Species.	Palæolithic implements.	Chipped Points and other implements of argillite.	Implements of argillite, quartzite, jasper and bone, pottery.	Implements of quartzite and jasper predominate over those of argillite; bone implements. Pottery of better grade. Ornaments of bone and shell, perforated stones
Man		×		
Bear		×	×	
Deer		×	×	×
Raccoon				×
Beaver		×		
Wildcat		×	×	
Opossum				×
Rabbit				×
Turtle				×
Duck				×
Wild Goose				×
Crane			×	
Sturgeon			×	
Catfish				×
Shad				×

No remains of extinct animals were found.

Most of the materials thus briefly commented upon having been placed in my hands but a short time since, with the request to transfer the collection as soon as possible to the Peabody Museum, I have not had time to make any conclusions from a study of the specimens. Although I superintended the excavation of the rock-shelter, so long a time has elapsed that it will be necessary to go over the material slowly, hunt up old notes that have been scattered, and also try to bring together portions of the collection now in other hands.

It remains for me to explain why I have first spoken of the rock-shelter, before speaking of the palæoliths found in aqueous deposits near Darley's Road, which crosses the Baltimore and Ohio railroad track, but a short distance from the locality that we have just examined. I have stated before that I was anxious to verify the several layers of the rock-shelter, and as the stakes of the railroad survey indicated that the place was doomed to destruction, for several weeks I followed the workmen as they slowly proceeded from Darley's Road Crossing toward what is now Carpenter Station, a quarter of a mile distant. I had already seen what is called by the country people the "Indian Field" cut in twain by these invaders of nature's solitudes, and must confess that it seemed to me a strange fatality that the shelter and the old Lenape council field stood directly in the line of destruction. When the work-gang reached Darley's Road Crossing, the excavation began to lay bare the gravels. Towards Wilmington, on the southwest side of the bridge, the layers terminated in a thin skein, but a few inches in thickness, and the boulder line which Professor Wright will describe in detail dwindled away to mere pebbles. As the work progressed toward Carpenter Station, in the direction of Philadelphia, the layers of brick clay widened somewhat, and the red-gravel deposit assumed a feature which seems to be better defined as we approach Wilmington, and less so to Philadelphia. I refer to the aqueous gravel deposit being subdivided, as it were, by its difference in color; generally red above (the true Philadelphia red-gravel color), while underneath it is grayish-reddish white. This peculiarity will be apparent to you, when Dr. Wright displays his lantern slides. The boulders of the boulder line, too, seem to increase in size as Philadelphia is approached; but I must not dwell upon these points in detail, interesting though they be, but tell you where the palæoliths were found.

Toward midday of July 13, 1887, while lying upon the edge of the railroad cut, sketching the boulder line, my eye chanced to notice a piece of steel-gray substance, strongly relieved in the sunlight against the red-colored gravel, just above where it joined the lower grayish-red portion that I have mentioned. It seemed to me like argillite, and being firmly embedded in the gravel was decidedly interesting. Descending the steep bank as rapidly as possible, the specimen was secured, not too quickly, for the workmen above were just beginning to tumble down a huge mass of boulders and gravel that had been undermined beneath, and then eased off, as they say, at the top by crowbars. Upon examining my specimen, I found that it was unquestionably a chipped implement. There is no doubt in my mind about its being firmly embedded in the gravel, for the delay I made in extricating it with my pocket knife nearly caused me the unpleasant position of being covered by several tons of gravel, to say nothing of the tongue lashing that I received from my friend, the section boss of the laborer's gang. It is to be regretted that the camera was not at hand to photograph the implement *in situ*, but this was impossible.

Having duly reported my find to Professor Putnam, I began, at his request, a thorough examination of the locality and on May 25, 1888, the year following, discovered another implement,[1] four feet below the surface, at a place about one-eighth of a mile from the first discovery. This was on Darley's road, the byway I have already mentioned. The road crosses the Baltimore and Ohio railroad track, a few degrees west of north, and leads toward what is known as "the red cut" from the fact that Darley's road at this point was excavated through a red gravel deposit which gave origin to its name. The point where the palæolith was found is a short distance above Joel Cloud's spring-house. The geological formation in which the implement was found seems to be a reddish gravel mixed with schist. Professor Wright who visited the spot with me has reserved his opinion upon the spot (with all due precaution), for the formation in this locality is a most difficult one to determine.

REMARKS UPON A CHIPPED IMPLEMENT, FOUND IN MODIFIED DRIFT, ON THE EAST FORK OF THE WHITE RIVER, JACKSON CO., INDIANA.

BY HILBORNE T. CRESSON.

The profile sketch[1], fig. 1, shows the position of gravel in which the large palæolith was found, on the east bank of White River, near the village of Medora, Jackson Co., Indiana.

The implement is thus shown to have been found in undisturbed gravel six inches distant from the boulder *R*, at *P*, the position indicated in the diagram. Its discovery was wholly a matter of accident. In company with Mr. W. R. Thompson of Philadelphia, in the month of May, 1886, I was making a casual examination of the gravel deposit along White river, when I noticed the boulder, and it was while digging with a hunting-knife about the boulder, in order to ascertain whether there were any glacial scratches upon it, that I found the palæolith. Careful study of gravel deposits in the valley of the Somme, where I had found implements of the river drift men in place, led me to recognize the importance of this discovery and take particular note of the fact that the palæolith lay in an undisturbed aqueous deposit.

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[1] For figures of these implements see pages 160, 161, following.

[2] Especial attention is called to the fact that the plan on page 151 was made after a very hasty examination of the locality. It cannot, therefore, be depended upon as an exact section of the supposed aqueous deposits referred to.

The implement is chipped from a mass of gray flint. It is triangular and measures 6½ inches in length, 3¾ inches in greatest width and is 1⅝ inches in thickness. It is now in the Peabody Museum at Cambridge, and bears the catalogue number 46145. See pages 162, 163 for figures.

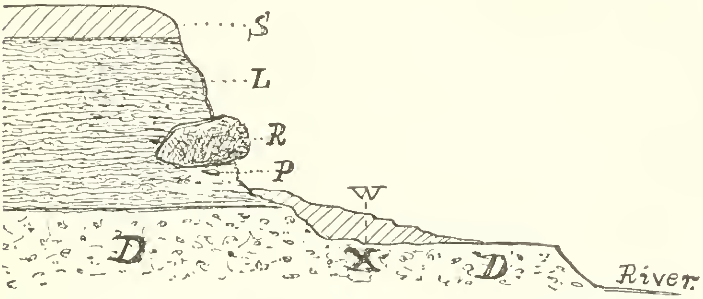

FIG. 1. Section of bluff at White River, Jackson Co., Ind. *S*, soil; *L*, gravel; *R*, boulder; *P*, position of the implement; *W-X*, talus; *D*, *D*, older gravel.

In relation to this gravel deposit on the White River, the following extract from a letter of my friend, Prof. G. F. Wright is of interest.

"From my notes it seems to me most likely that the situation is nearly identical with that at Trenton. The east fork of the White River occupies a very interesting relation to the ice movement, as a glance at the glacial boundary will show. The Illinois lobe of ice which crosses the outlet of White River extends considerably farther south than the lobe extending to the vicinity of Louisville and occupied by the head waters of the stream. This would have prevented much of a secondary glacial accumulation from taking place through Davies, Martin and Lawrence Counties.

And so I found it in fact. There is no evidence of much glacial drainage through those counties. But the glacial drainage was east of the knobs towards Louisville, Kentucky. This the Indiana geologists early perceived and called the glacial stream Collet's River. Medora lies a few miles west of where I located the boundary of direct glaciation, but in a valley where water deposits from the ice front would have been likely to have accumulated to a considerable extent. It is quite possible that the deposit marked *D* is a direct glacial deposit. If not it is what accumulated in the temporary lake which existed there for a while when the mouth of the river was dammed up by the Illinois loess. The triangular glaciated space in southern Indiana must have been a favorable place for preglacial man, and its borders present just the conditions for the preservation of his remains."

THE AGE OF THE PHILADELPHIA RED GRAVEL.

BY G. F. WRIGHT.

The discovery of palæolithic implements, as described by Mr. Cresson near Claymont, Del., unfolds a new chapter in the history of man in America. It was my privilege in November last to visit the spot with him, and to spend a day examining the various features of the locality, and the views presented on the screen have brought the situation vividly before your eyes.

Notwithstanding the danger of a little repetition, I will state that the cut in the Baltimore and Ohio railroad in which this implement was found is about one mile and a half west of the Delaware river, and about one hundred and fifty feet above it. The river is here quite broad. Indeed, it has ceased to be a river, and is already merging into Delaware bay; the New Jersey shore being about three miles distant from the Delaware side. The ascent from the bay at Claymont to the locality under consideration is by three or four well-marked benches. These probably are not terraces in the strict sense of the word, but shelves marking different periods of erosion when the land stood at these several levels, but now thinly covered with old river deposits. Upon reaching the locality of Mr. Cresson's recent discovery, we find a well-marked superficial water deposit containing pebbles and small boulders up to two or three feet in diameter, and resting unconformably upon other deposits different in character; and in some places directly upon the decomposed schists which characterize the locality. This is without question the Philadelphia Red Gravel and Brick Clay of Lewis[1]. The implement submitted to us was found near the bottom of this upper deposit, and eight feet below the surface. Not more than a mile from the same locality was a shelter-cave carefully explored by Mr. Cresson many years ago in which also palæolithic implements were found in the bottom beneath large accumulations of debris. The same railroad has cut through this also, and the continuity of the superficial deposit is manifest from one place to the other. As Mr. Cresson was on the ground when the implement was uncovered, and took it out with his own hands, there would seem to be no reasonable doubt that it was originally a part of the deposit, for Mr. Cresson is no novice in these matters, but has had unusual opportunities, both in this country and in the old world, to study the localities, where similar discoveries have heretofore been made. The absorbing question concerning the age of this deposit is therefore forced upon our attention as archæologists, and to this we will direct our discussion.

The determination of the age of these particular deposits at Claymont involves a discussion of the whole question of the Ice Age in North America, and especially that of the duality of the glacial epoch. At the meeting of this Society on Jan. 19, 1881, I discussed the age of the Trenton Gravel, in which Dr. Abbott has found so many palæoliths and was led also incidentally at the same time to discuss the relative age of what Professor Lewis called the Philadelphia Red Gravel.[2] I had at that time recently made repeated trips to Trenton, and with Professor Lewis had been over considerable portions of the Delaware valley for the express purpose of determining these questions. The conclusions to which we, that is, Professor Lewis and myself, came were those expressed in the paper above referred to; namely, that the Philadelphia Brick Clay and Red Gravel (which are essentially one formation) marked the period when the ice had its greatest extension, and when there was a considerable depression of the land in that vicinity; perhaps, however, less than a hundred feet in the neighborhood of the moraine, though increasing towards the northwest. During this period of greatest ice-extension and depression, the Philadelphia Red

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[1] For Lewis's Views see Abbott's Primitive Industry, pp. 324, 335; "The Surface Geology of Philadelphia and Vicinity," Proc. Acad. Nat. Sci. of Phil., Nov. 25, 1888; "Geology of Philadelphia," Journal of Franklin Institute, June, 1883.

[2] See "Proceedings," Vol. XXI, Jan. 19, 1881, pp. 137–145.

Gravel and Brick Clay were deposited by the ice-laden floods which annually poured down the valley in the summer seasons.

As the ice retreated towards the headwaters of the valley, the period was marked also by a reëlevation of the land to about its present height, when the later deposits of gravel at Trenton took place. Dr. Abbott's discoveries at Trenton prove the presence of man on the continent at that stage of the glacial epoch. Mr. Cresson's discoveries prove the presence of man at a far earlier stage. How much earlier will depend upon our interpretation of the general facts bearing on the question of the duality of the glacial epoch.

Mr. McGee of the United States Geological Survey has recently published the results of extensive investigations carried on by him respecting the superficial deposits of the Atlantic coast.[1] He finds that on all the rivers south of the Delaware there are deposits corresponding in character to what Professor Lewis had denominated Philadelphia Red Gravel and Brick Clay. These deposits are rather coarse at the bottom and fine at the top, though boulders two or three feet through frequently occur in the clay, showing that the currents of water were ice-laden at the height of the period. But according to Mr. McGee these deposits diminish both in extent and elevation as we proceed southward along the coast. But still the marked evidence of floating ice is seen in the occasional boulders enclosed in the finer material. From the extent to which this deposit is developed at Washington in the District of Columbia, Mr. McGee prefers to designate it as the Columbia formation. But the period is regarded by him as identical with that of the Philadelphia Red Gravel and Brick Clay which Professor Lewis had attributed to the period of maximum glacial development on the Atlantic coast.

It is observable that the boulders in this Columbia formation belong, so far as we know, in every case, to the valleys in which they are now found. The boulders in the Philadelphia Brick Clay are all from the Delaware valley, and so, about Baltimore, the corresponding deposits can be traced to the local valleys converging at that point. At Washington the boulders and pebbles are all from the Potomac valley. It is observable also that it is not necessary in any case to suppose that these deposits were the direct results of glacial ice. Mr. McGee does not suppose that glaciers extended down these valleys to any great distance. In deed, so far as we are aware, there is no evidence of even local glaciers in the Allegheny Mountains south of Harrisburg. But, it is easy to see, that an incidental result of the glacial period was a great increase of snow and ice in the headwaters of all these streams, so as to add greatly to the extent of the deposits in which floating ice is concerned. And this Columbia formation is, as we understand it, supposed by Mr. McGee to be the result of this incidental effect of the glacial period in increasing the accumulations of snow and ice along the headwaters of all the streams that rise in the Alleghenies. In this we are probably agreed. But Mr. McGee differs from the interpretation of the facts given by Professor Lewis and myself in that he postulates, largely, however, on the basis of facts outside of this region, two distinct glacial epochs, and attributes the Columbia formation to the first epoch, which he believes to be from three to ten times as remote as the period in which the Trenton gravels were deposited. If, therefore, Dr. Abbott's implements are, as from the lowest estimate would seem to be the case,[1] from 10,000 to 15,000 years old, the implements discovered by Mr. Cresson in the Baltimore and Ohio cut at Claymont, which is certainly in Mr. McGee's Columbia formation, would be from 30,000 to 150,000 years old.

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[1] See Am. Jour. Sci., Vol. XXXV, Feb., April, May and June, 1888.

But as I review the evidence which has come to my knowledge since writing the paper in 1881 I do not yet see the necessity of making so complete a separation between the glacial epochs as Mr. McGee and others feel compelled to do. But, on the other hand, the unity of the epoch (with, however, a marked period of amelioration in climate accompanied by extensive recession of the ice, and followed by a subsequent readvance over a portion of the territory) seems more and more evident. All the facts which Mr. McGee adduces from the eastern side of the Alleghenies, comport, apparently, as readily with the idea of one glacial period as with that of two. I must add also, that the subsidence which Mr. McGee assumes in the valley of the Susquehanna above Harrisburg is much greater than Professor Lewis and myself had supposed necessary when we went over the field. Professor Lewis never, I believe, placed the limit of the Philadelphia Brick Clay as more than two hundred feet above the streams either in the Delaware or the Susquehanna valley. But Mr. McGee speaks of deposits above

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[1] See my paper on the "Age of the Ohio Gravel-beds," Proc. of Boston Soc. Nat. Hist., Vol. XXIII, p. 436, Dec. 21, 1887.

Bloomsburg in the Catawissa Hills, Luzerne county, which he attributes to the Columbia floods, as reaching to the height of five hundred feet above the Susquehanna. It will be observed, however, that this is very near the margin of the terminal moraine as laid down by Professor Lewis and myself across the Susquehanna valley. But both of us became convinced that we did not, when examining that region, give sufficient attention to what we afterwards denominated the "fringe," — that is, to the scattered indications of direct glacial action found over a belt more or less wide in advance of the heavier deposits, which could more properly be called "terminal moraine."[1] In our report on this locality we refer to occasional transported boulders found upon hilltops in front of the moraine in the vicinity of the Susquehanna and Delaware rivers, and which, Professor Lewis remarks, it is difficult to explain, upon any theory of a flood, and that they may be of like origin with the fringe farther west. In view of these facts, therefore, I suspect at present that the highest boulders, to which Mr. McGee refers on the Catawissa hills in the vicinity of the Susquehanna, are the direct results of glacial action; the ice itself having extended that far below the terminal moraine. I am confirmed in this belief from the fact, that below this point on the way to Harrisburg, Mr. McGee does not find the deposits much above the two hundred foot line at which Professor Lewis had limited it. Until further examination of the district with these suggestions in view, or until a more specific statement of facts than we find in Mr. McGee's papers, it would therefore seem unnecessary to postulate a distinct glacial period to account for the Columbia formation.

Time would fail us, however, to enter into the whole discussion relating to the various stages of glaciation brought to light by recent investigations in North America. But no matter which view prevails, whether that of two distinct glacial epochs or of one prolonged epoch with a mild period intervening, the Columbia deposits at Claymont, in which these discoveries of Mr. Cresson have been made, are older (perhaps by many thousand years) than the deposits at Trenton, N. J., at Loveland and Madisonville, Ohio, at Little Falls, Minn. (of which more particular account was given this society a year ago), and at Medora, Ind., of which Mr. Cresson has given us an account to-night. Those all belong to the later portion of the glacial period, while these at Claymont belong to the earlier portion of that period, if they are not to be classed according to Mr. McGee as belonging to an entirely distinct epoch.

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[1] See "Pennsylvania Report," Z, p. 201.

Dr. C. C. Abbott exhibited a water-worn pebble, showing unmistakable evidence of artificial chipping, which he had taken from the bed of the Delaware river, near Trenton, N. J., where the stream flows over the most extensive deposit of the "Trenton gravel;" and called attention to the identical character of its surface with that of the associated pebbles. The specimen was found so far from the banks of the stream, that it was apparent it could not have been recently washed from them during a flooded condition of the river, nor even dropped by Indians into the water, as unquestionable relics of that class found in the river show but a slight water-worn condition. The archæological interest of the specimen centred in the fact that like objects (palæolithic implements) when found in the undisturbed gravel always exhibit an unworn and dull surface, due to atmospheric and chemical conditions operating upon them. Thus all objects from the gravel, where oxide of manganese or of iron occurred, have been found to be coated alike; thus showing that they had been exposed to the action of these salts for the same length of time. This uniformity of the condition of the surface of both the natural pebbles and chipped objects was held to be important evidence that the latter were of the same age.

Dr. Abbott also exhibited a quartz implement found in place in the Trenton gravel, at a depth of eleven feet, which was of identical pattern with some of those found by Miss Babbitt, at Little Falls, Minn. But four quartz implements have been collected from the Trenton gravel, and three of them are of this same pattern, which is one that does not occur, apparently, among the objects, of like age, made of argillite.

The President said that the importance of Mr. Cresson's discoveries, in the gravel and in the rock-shelter, could not be overestimated. The two implements (figs. 1 and 2) which he had found in the gravel, as shown by Professor Wright in the views which he has exhibited to us this evening, were from gravel beds much older than the Trenton, and corresponding to the Columbia gravel of McGee. Should the great antiquity now given to these lower gravels remain unchallenged, it would place man in the Delaware valley at a time long before the deposition of the Trenton gravels.

Bearing upon this question, it must be remembered that we have one palæolithic implement found, four feet from the surface, in the older gravel upon which the Trenton rests, at Trenton, New Jersey. This specimen was sent to the Peabody Museum by Dr. Abbott's son Richard, and I have brought it here for your examination.

The results of Dr. Abbott's investigation of the river-bed in the vicinity of Morris Island, below Trenton, which he has given us to-night, are of special interest, as they show that the stone implements, once buried by the Trenton gravel, have since been washed out of the gravel by the action of the river, and are now found upon its bed associated with other water-worn stones. Two of these water-worn implements are before you for examination and comparison with others taken from the gravel.

Mr. Cresson's discovery of a chipped-flint implement of large size (fig. 3), in place in the gravel of White river, Indiana, is another important fact in relation to the distribution of early man in America. Professor Wright has shown to us this evening, by a series of instructive lantern pictures, the continuity of this gravel deposit in Indiana with that of New Jersey, from which about four hundred implements have been taken by Dr. Abbott, and that of Ohio, from which we have two implements found by Dr. Metz.

Referring to Mr. Cresson's examination of the rock-shelter in Delaware, we have before us a series of objects taken from the several layers of the shelter, which give us a chronology of the utmost importance, as each period of occupation of the shelter was followed by a natural deposition, separating the different periods of occupation. The stone implements upon this tablet were taken from the lowest layer, indicating the earliest period of occupation of the rock-shelter; and, as you will see, they correspond in shape and rudeness of execution with those taken from the gravel-bed at Trenton, and like most of the latter, they are all of argillite. These specimens from the second period are of argillite, and while many are chipped into slender points, they are still of very rude forms; and these in turn correspond with the argillite points found by Dr. Abbott deep down in the black soil, or resting upon the gravel, at Trenton. In the upper layers of the shelter, we observe, as on this tablet, the gradual introduction of implements chipped from jasper and quartz, and corresponding in form with those found upon the surface throughout the valley. And as a further indication of this later development, it was only in the upper layers that pottery, bone implements, and ornaments of shell, bone and stone were found. The three distinct periods of occupation of the Delaware valley are thus distinctly shown; and this rock-shelter is a perfect exemplification of the results which Dr. Abbott obtained from a study of the specimens which he has collected upon the surface, deep in the black soil, and in the gravel, at Trenton.

The President then alluded to a recent paper by Mr. McGee, as a clear presentation of the geological condition under which early man existed in North America, but it is to be regretted that Mr. McGee had not examined the collection of palæolithic implements in the Peabody Museum, before writing his paper; for, had he done so, he would not have fallen into several errors in relation to some of the objects. Particularly in intimating that the specimens obtained by Miss Babbitt in the drift at Little Falls, Minn., were simply chips of quartz and of doubtful artificial character. To show that this was an error, the President exhibited a number of specimens, sent to the Peabody Museum by Miss Babbitt, all of which were found associated and in place in the river drift, a description of which has been given by Mr. Upham in a carefully prepared paper at one of our meetings last winter. These specimens found by Miss Babbitt are all of white quartz, and while some are simply chips, others of these before you are identical in shape as well as material with the specimens obtained by Dr. Abbott in the Trenton gravel, and certainly their artificial character will not be questioned. Fig. 4 is of one of these quartz implements from the Trenton gravel placed here for comparison with fig. 5, which is one of the quartz implements from Little Falls. Figs. 6 and 7 are two other chipped implements of quartz from Little Falls. Certainly these are something more than chips and are unquestionably artificial.

The President then alluded to the importance of the collection of palæolithic implements in the Peabody Museum at Cambridge, where nearly all the specimens obtained from the Trenton gravel, the two from the Delaware, one from the Indiana, and the two from the Ohio gravels, with a large proportion of those collected by Miss Babbitt at Little Falls, are exhibited side by side.

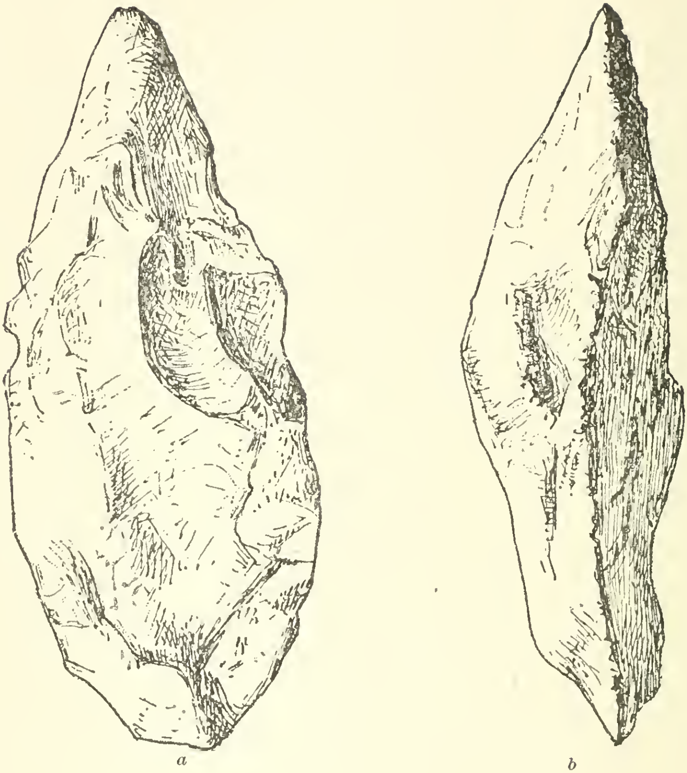


FIG. 1. *a*, face; *b*, side view, actual size. Implement of argillite from gravel, 8 to 9 ft. below overlying bed of clay. B. & O. R. R. cut near Carpenter's Station, Newcastle Co., Delaware. Peabody Museum, No. 45726. From Mr. Cresson.

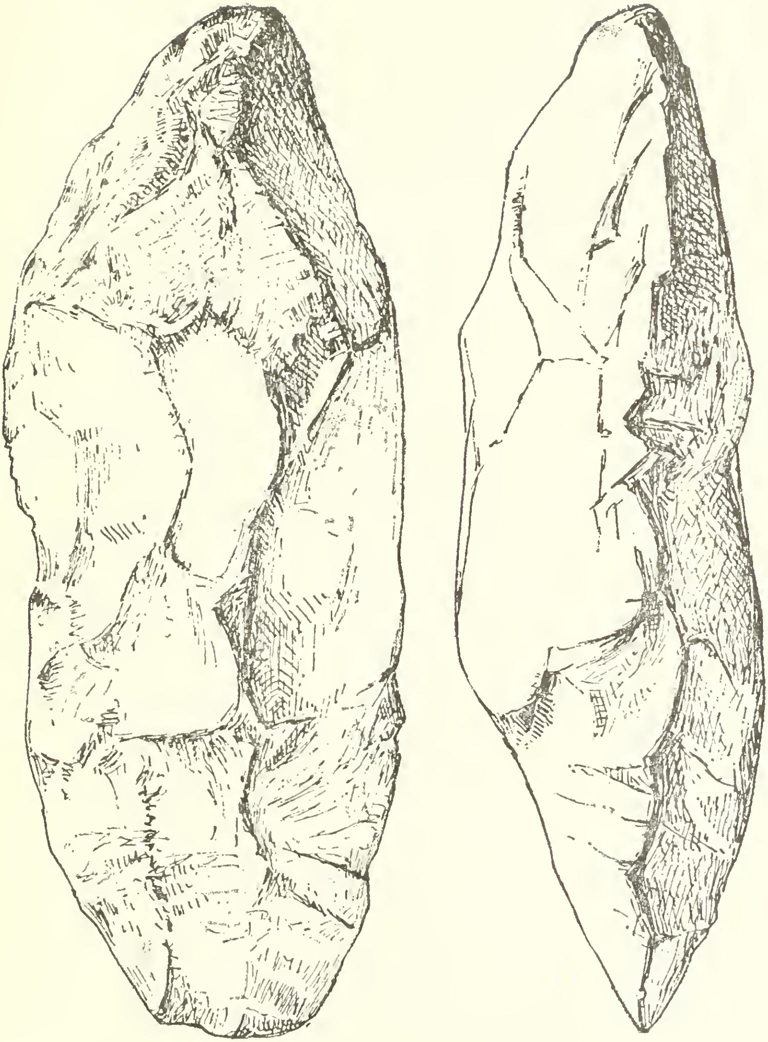


FIG. 2. *a*, face; *b*, side view, actual size. Implement of argillite. From gravel at Red Cut on B. & O. R. R., Carpenter's Station, Newcastle Co., Delaware. Peabody Museum, No. 16144. From Mr. Cresson.

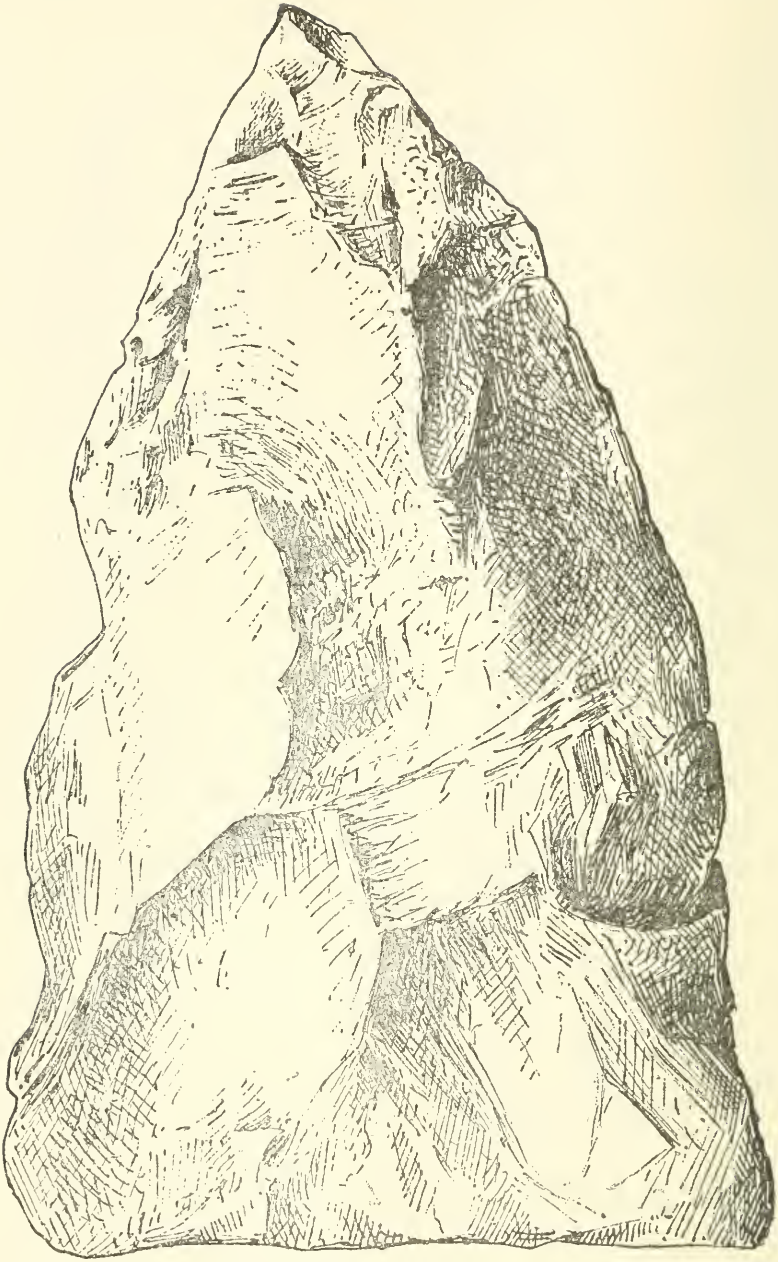


Fig. 3, *a*. Actual size. Implement of gray flint in gravel 11 ft. from surface. Bluff East Fork of White River, Jackson Co., Indiana. Peabody Museum, No. 46145. From Mr. Cresson.

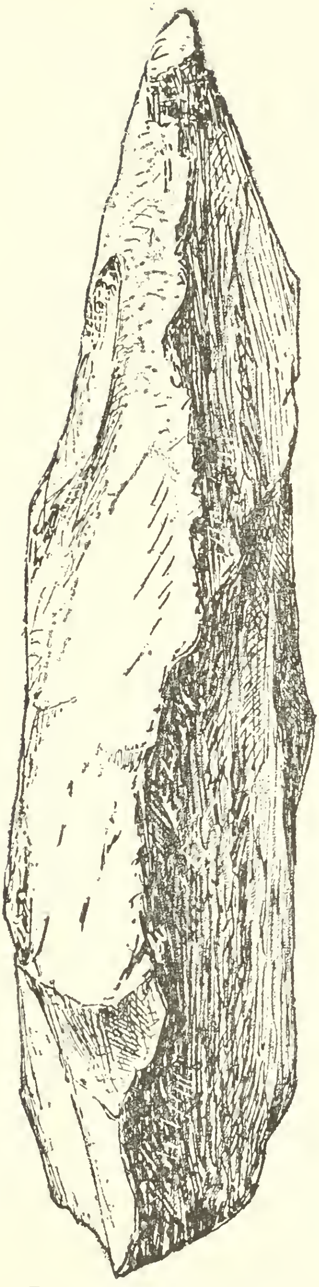
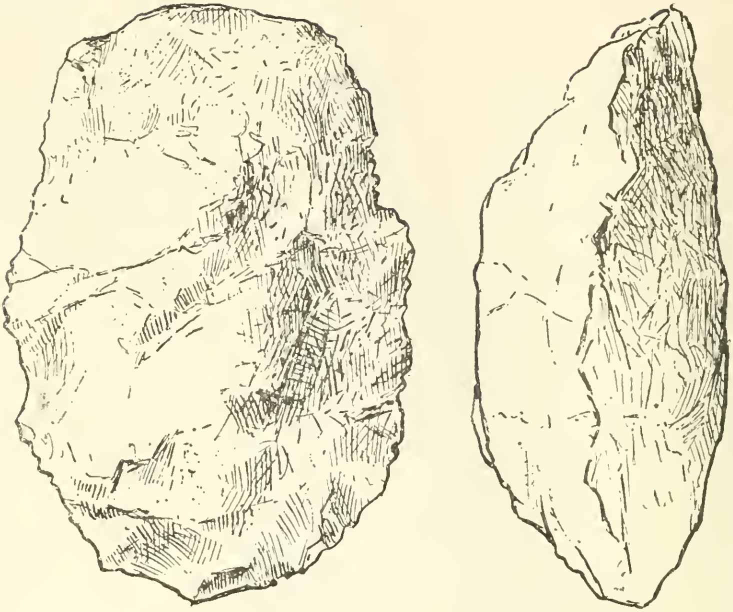
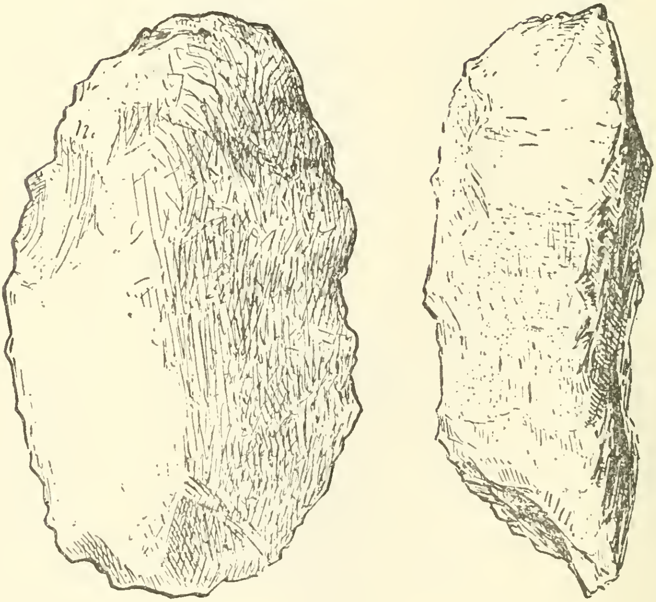


FIG. 3, *b*. Side view of Fig. 3.



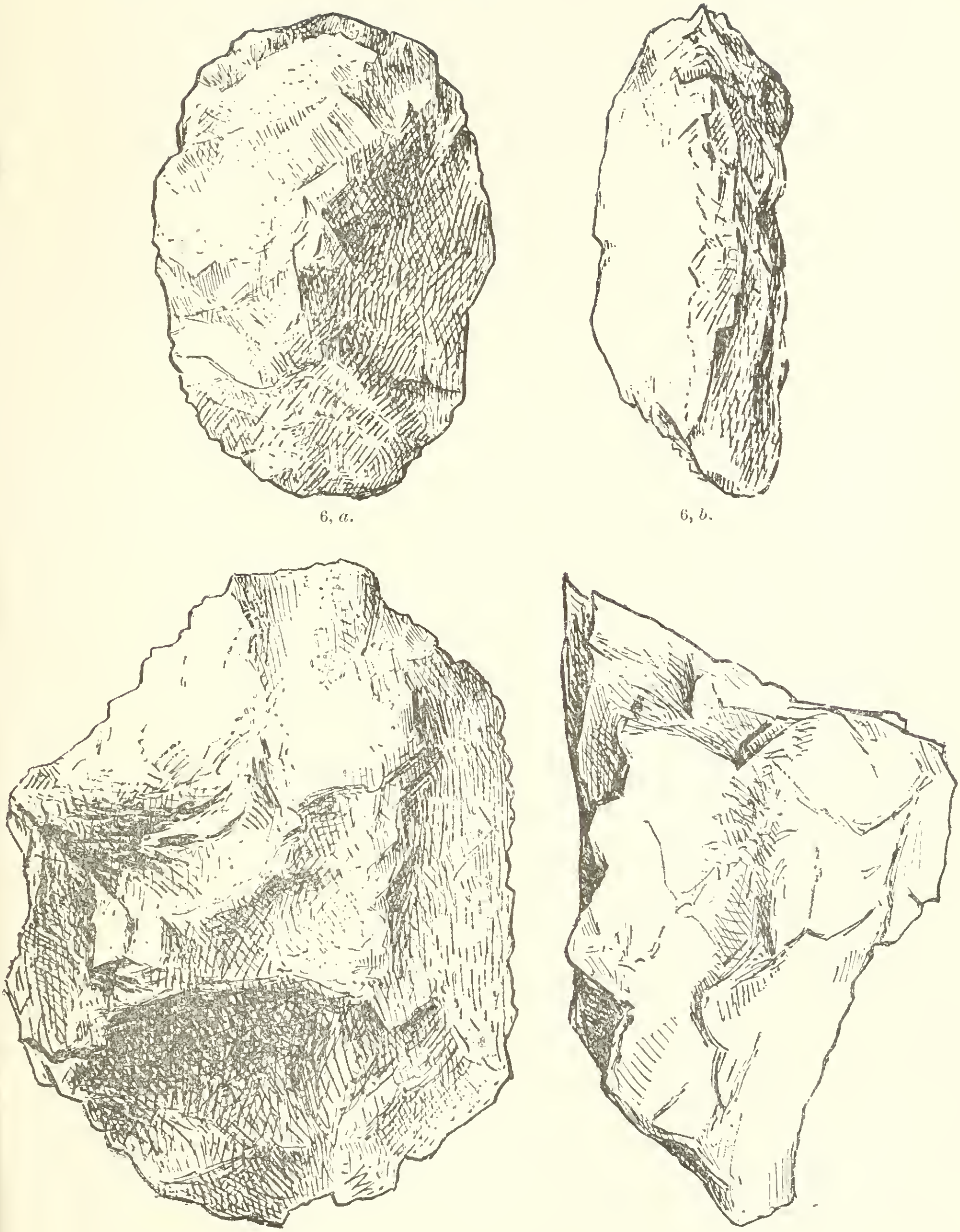
4. *a*. 4, *b*.



5, *a*. 5, *b*.

FIG. 4. *a*, face; *b*, side view, actual size. Implement of quartz from gravel, Penn. R. R. cut, Trenton, New Jersey. Peabody Museum, No. 33164. From Dr. Abbott.

FIG. 5. *a*, face; b, side view, actual size. Implement of quartz from modified drift at Little Falls, Minn. Peabody Museum, No. 31331. From Miss Babbitt.



6, *a*. 6, *b*.

7, *a* 7, *b*

FIGS. 6, 7. *a*, face; *b*, side view, actual size. Implements of quartz, from modified drift at Little Falls, Minnesota. Peabody Museum, Nos. 31316, 34088. From Miss Babbitt.